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ber of Cubans, *Michigan* the largest number of Mexicans and *Pennsylvania* the largest number of West Indians. Of the North American countries, Canada sends the largest number of students—161—followed by Mexico with 48 and Cuba with 40. *Cornell* leads in the Argentine Republic, Brazil, Ecuador and Peru; *Columbia* in Colombia, and with *Pennsylvania* in Chili, although the representation in the last two countries is insignificant. Of the South American countries, Brazil sends the largest representation, namely, 20, followed by the Argentine Republic with 15 and Peru with 12. In the European countries that send ten or more students the order is as follows: France—*Pennsylvania*, *Columbia*, *Harvard*; Germany—*Columbia*, *Harvard*; Great Britain and Ireland—*Columbia*, *Pennsylvania*, *Harvard*; Italy—*Pennsylvania*, *Harvard*; Russia—*Pennsylvania*, *Columbia*; Turkey—*Yale*, *Harvard*. Great Britain and Ireland sends the largest number, namely, 44, followed by Germany with 37, France with 35 and Turkey with 30. Of the Asiatic countries, Japan sends 110, China 38 and India 20, the representation from the other countries being unimportant. *Columbia* draws the largest number of students from China, leads with *Yale* in Japan, and follows *Cornell* in India. Of the Australasian countries, Australia sends 30 and New Zealand 16, *Pennsylvania* leading in both, followed by *Cornell* in the former and by *Harvard* in the latter.

RUDOLF TOMBO, JR.

#### SCIENTIFIC BOOKS.

*The Analysis of Racial Descent in Animals.*

By THOMAS H. MONTGOMERY, JR., Professor of Zoology in the University of Texas. Pp. xi + 311. Henry Holt & Co. \$2.50.

A general and comprehensive work on the methods of determining racial descent has not appeared within recent years and Haeckel's 'Generelle Morphologie,' first published in 1866, still remains the standard work on this

subject. The insufficiency of some of the methods outlined by Haeckel has been repeatedly pointed out, but there are few, if any, works which deal with these methods both critically and constructively. Recent analytical studies in biology have turned the interest and sympathies of many biologists away from the more general, if less exact, speculations of the older school, and have brought the study of phylogeny into a certain disrepute. Nevertheless, as the author says in his preface, "many of the broader concepts of biology have been obtained from just such investigations. As to the degree of uncertainty in its conclusions, this results simply from the great extent of the phenomena to be explained and from their complexity."

The first chapter of this work deals with 'Environmental Modes of Existence.' In addition to the general classification of organisms into the *geobios*, *limnobios* and *halobios* of Haeckel, the author recognizes two other groups—the *diplobios* (organisms which spend part of their life in one medium, part in another) and the *entobios* (entoparasites); the first three of these modes of existence he groups together under the name *monobios*, the last two under *heterobios*.

The question as to which of these modes of existence is the most primitive is interestingly discussed and the conclusion reached that the evidence favors the hypothesis of Simroth that 'the sea beach from the region of high tidal limit to a short distance below the low tidal, is the probable point of origin of most animal groups.'

Regarding the seasonal migrations of various animals the author concludes that there is no evidence that the earliest environment of the young represents the ancestral home of the species. As to the method of origin of entoparasites he concludes that where there are a number of different hosts in the life history of the parasite, *e. g.*, Trematodes, the host in which the adult condition is reached is the primitive one, whereas the occurrence of younger stages in an intermediate host is a later adaptation. "Here the ontogeny would be a reversal of the phylogeny with regard to the sequence of hosts."

In the second chapter on 'Heredity and Embryonic Differentiation' the author gives a brief account of the statistical, and a more extended account of the cytological studies of heredity. He calls attention to the importance of the nuclear linin in the preservation of the characteristic number and form of the chromosomes and he concludes that the linin should always be considered along with the chromatin and that both linin and chromatin constitute the germ-plasm. The hereditary significance of the conjugation of male and female chromosomes, and of their separation in the reduction division first discovered by the author, is discussed. In his treatment of embryonic differentiation the position is taken that the ability of egg fragments to give rise to whole embryos, no more indicates the undifferentiated character of the fragments than the similar ability on the part of adult planarians.

The third chapter on the 'Relations of Modes of Reproduction and Conjugation' is less convincing in its conclusions than the preceding ones. The evidence presented in favor of the view that fragmentation is more primitive than binary fission is not convincing; and the same is true of the conclusion that Geddes and Thompson's theory of sex must be abandoned because sexuality is 'the state of occurrence of dissimilar individuals,' only one of which, the egg, has the power to reproduce. Similarly the conclusion that the male is morphologically and physiologically inferior to the female, while supported by many examples, meets with so many exceptions as to cast doubt upon its general applicability or value. The statement that 'sexuality finds its expression and origin in extra-chromosomal differences' does not accord with the recent careful work of Stevens and Wilson. And the statement that every Metazoan formed from a fertilized egg cell is initially a hermaphrodite, because formed by the fusion of male and female germ cells, while an animal arising from an unfertilized egg is initially female, though it may later become male, seems to the reviewer to confuse sex with sex cells and thereby to create many needless difficulties. Finally the evidence brought forward at the close of

the chapter in favor of the view that 'eventual hermaphroditism' is a secondary condition and not primitive is not wholly satisfactory, for it does not necessarily follow that 'because of its [separate sexes] more general occurrence it would seem to be more primitive.'

The fourth chapter contains an extensive treatment of 'Life Cycles and Polymorphism of Individuals.' The author concludes that 'all cases of metagenesis have originated from larval development, and that asexual reproduction is limited to an immature or larval stage.' Practically he makes no distinction between larval development with metamorphosis and metagenesis, or in his own words, 'All discontinuous larval development is metagenetic, in that the adult is formed asexually, by budding from the larva.' This discussion is of service in showing that there is no hard and fast line between metagenesis and discontinuous larval development, but there seems to be no good reason for changing the old definition of metagenesis, viz., 'an alternation of a sexually produced generation or person with an asexually produced one,' for this new definition, even though in some cases there may be no sharp line of demarcation between the alternation of 'persons' in metagenesis with the alternation of 'organs' in larval development.

Under 'ekdytic development' the author includes those cases, commonly known as fetal development, in which special annexes are formed, which are later lost. He considers that Beard is right in classifying fetal development as discontinuous, but wrong in regarding it as a form of larval development.

The fifth chapter deals with 'Variations and Mutations' and represents in a brief form the relations of the mutation theory of de Vries to the germ-plasm theory of Weismann. The tabular classification (p. 135) of the conditions of variation and mutation, and of the resulting types of variants and mutants is a brief and useful summary. As to the cause of atypical forms he says (p. 146): 'Our conclusion is that variation, progressive or regressive, and also mutation, in fact any inherited modification of the race, is instituted by stimulus of the environment'; and again

he says (p. 149): "It follows, accordingly, that in neither of the known kinds of bastardization, the Mendelian or the unisexual, is there any evidence that variations or mutations are produced by these processes. Parental qualities are transmitted according to more or less definite laws, but no new ones are produced." On the basis of such considerations he concludes that acquired characters are inherited. "Indeed the very postulation of the question, 'are acquired characters inherited?' is absurd. It should read rather, 'what kinds of acquired characters become inherited?'" Regarding the statement of de Vries that the answer to this question 'depends to a great extent upon a word play; just according as one chooses his definition for acquired characters, he regards them as heritable or not,' Montgomery says:

Here, however, de Vries himself makes a word play; acquired characters, according to him, are those only which do not arise suddenly, *i. e.*, individual variations and not mutations. But according to all essential ideas of his mutation theory the mutations are much more distinctly, even solely, steps in the formation of races, and a step in racial progress is surely nothing less than an acquisition.

This is as striking an illustration as could be found of the need of clear definitions, and of the fact that long continued discussions in science more frequently arise from misunderstandings than from fundamental differences of opinion. For what Montgomery calls 'acquired characters' or 'steps in racial progress,' would be called by Weismann or de Vries 'germinal characters,' while the question of the transmissibility of 'acquired characters' in the sense of Weismann, *i. e.*, somatic characters which are, *ex hypothesi*, not represented in the germ, is not discussed by Montgomery. Weismann and many others use the term 'acquired character' in a peculiar and specific sense, Montgomery with a general and colloquial meaning.

The sixth chapter deals with the 'Transmutation of Species.' It begins with an appreciative account of the part of Lamarck in establishing the theory of evolution, and an interesting discussion of the question of the

monophyletic or polyphyletic origin of organisms. The unfortunate prominence of hypothetical ancestors in many evolutionary discussions is excellently set forth in these words: "From the casual inspection of certain writings, and most unfortunately those intended for beginners, one might infer that the *Moneron*, the *Gastræa*, the *Trochozoon*, and the *Bathybius* were more important, if not more real, than the living animals around us."

He concludes that transmutations are definitely directed and that they may be discontinuous, by means of mutations, as de Vries has shown, or continuous, by means of variations. As an illustration of the latter he considers the different geographical races or subspecies of the song sparrow, *Melospiza cinerea*, the geographical as well as morphological intergradations of which indicate that these are not mutants but variants. He concludes, therefore, that 'the mutation theory has not disproved the possibility of perfectly gradual transmutation of species, but has only shown that sometimes transmutation may not be a gradual process.' The author takes an equally broad view with regard to the causes of mutation and variation, holding that 'the factors are neither purely extrinsic, nor purely intrinsic, but a combination of the two.'

The chapter on the 'Parallelism of the Ontogeny and the Phylogeny' contains an extremely interesting and valuable résumé of the 'recapitulation theory.' This is followed by a critical consideration of the whole question, and the conclusion is reached "that the embryology does not furnish any recapitulation of the phylogeny, not even a recapitulation marred at occasional points by secondary change. \* \* \* An analysis of the stages during the life of one individual can in no way present a knowledge of its ancestry; and the method of comparing non-correspondent stages of two species is entirely wrong in principle."

In the chapter on 'Morphological Comparisons' the author argues that in comparison of organisms the whole life cycle should be considered as well as all structural characters, and he strongly insists that only corresponding stages in the ontogeny can properly

be compared, the two stages, which can be most readily determined to be correspondent, being the first and the last. This, together with the greater amount of differentiation found in the adult stage, leads him to the conclusion that end stages in the ontogeny are more important for purposes of comparison, than any other stages. The rigid application of this principle leads him to some very unusual conclusions; *e. g.*, most zoologists will be astonished at the statement that *Sacculina* is not a Crustacean, because in its adult condition it has lost the Crustacean characters which it possessed as a larva. Similarly the statement that the group Chordata is inadmissible because tunicates, Amphioxus and vertebrates are very unlike in the adult condition, though their larvæ show fundamental resemblances, seems to the writer to be out of harmony with the broad and liberal method of comparison advocated in the closing section of the chapter, *viz.*, 'to neglect nothing, to consider every property, kind of individual, every embryonic stage,' etc.

The chapter on the 'Relative Values of Morphological Characters' deals with many interesting questions. The author concludes that types of symmetry—radial, spiral, bilateral—are of little phylogenetic significance, but that metameric segmentation is of great importance. An excellent review of the theories as to the origin of metamerism is followed by the author's view that metamerism has arisen, not from asexual reproduction, but from division of organs, 'Just as one cell gives rise to others by division, so one organ produces others by division.'

In general the conclusion is drawn that the most important of all morphological characters for the purpose of comparison are those which relate to the relative position and connection of parts.

In the tenth chapter the 'Criteria of Racial Advancement' are discussed. Whether an organism is to be regarded as 'high' or 'low,' is, according to the author, dependent entirely upon the length of its line of descent, irrespective of its final complexity or simplicity. This again leads to some very unusual conclu-

sions and causes one to doubt the value of any such definition.

Limits of space have made it necessary to consider only a few of the subjects treated in this work, and the author's conclusions have been stated without presenting the cogent, if not always convincing, arguments by which these conclusions are reached, nevertheless this review will serve to show the great extent and importance of the subjects treated. The author's intimate acquaintance with the great wealth of phenomena and with the extensive literature dealt with in this book, makes it one of particular importance and value to biological students.

E. G. CONKLIN.

#### SCIENTIFIC JOURNALS AND ARTICLES.

The *Journal of Comparative Neurology and Psychology* for July contains the following articles: Dr. G. E. Coghill describes the 'Cranial Nerves of *Triton tæniatus*,' comparing the microscopic anatomy and nerve components with *Amblystoma* and the forms described by Drüner. 'Retrograde Degeneration in the Spinal Nerves,' by S. Walter Ranson. An experimental study of the atrophic changes in both spinal nerves and the cells of the spinal ganglia and spinal cord with special reference to the differences between the typical Wallerian and the retrograde degeneration. 'The Primitive Pores of *Polydon spathula*,' by Herbert D. Kistler, describes with a plate the peculiar sense organs on the bill of the spoon-bill catfish. 'The Reactions of Crayfish to Chemical Stimuli,' by James Carleton Bell. A careful examination of the whole body surface to discover its sensitiveness to various types of chemical solutions. An editorial on abnormal psychology and book notices complete the number.

THE *Botanical Gazette* for July contains the following papers: E. C. Jeffrey and M. A. Chrysler discuss the Cretaceous *Pityoxyla*, describing two new species, one from the Middle Cretaceous of Staten Island, the other from Massachusetts. Certain differences from modern pines are pointed out and regarded as ancestral. H. L. Shantz publishes a result of his study of the vegetation of the Mesa region